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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/051,984 | 01/15/2002 | Michael Richard Ehlert | NSC1P202/P04892 | 1583 |

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EXAMINER

PATEL, ISHWARBIHAI B

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| ART UNIT | PAPER NUMBER |
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2827

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/051,984

Applicant(s)

EHLERT ET AL.

Examiner

Ishwar (I. B.) Patel

Art Unit

2827

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12, 14-19 and 25-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 14-19 and 25-27 is/are rejected.
- 7) ☒ Claim(s) 8-12 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 February 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No. (s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The corrected or substitute drawings were received on February 25, 2003.

These drawings overcome the prior rejection. However, upon further review, few new deficiencies found as described below.

The drawings are further objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the plurality of ceramic layers, and electronic component embedded within the plurality of ceramic layers, as claimed in all the claims must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 2 and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 2 and 10, which depend upon claims 1 and 8 respectively, the applicant is claiming a "the barrier cap prevents the first electrically conductive material within the through-hole from making contact with the second electrically conductive material forming the contact pad", however, the structure, barrier cap, is already claimed in claims 1 and 8 respectively, and is not clear what additional structural limitation is added in claims 2 and 10.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-7 and 15-19, 25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al., US Patent No. 5, 847,326, hereafter Kawakami, in view of Kumagai et al, US Patent No. 5,043,223, hereafter, Kumagai.

Regarding claim 1,2 and 15, Kawakami discloses a circuit structure having plurality of ceramic layers, wherein a first one of the ceramic layers comprises:

a through hole that passes through the first ceramic layer, the through being filled with a first electrically conductive material, which forms a via (through hole 13 in a

ceramic layer 12 and filled with conductive paste of Ag, see figure 1, column 2, line 58 to column 3, line 10);

a contact pad formed from a second electrically conductive material that is different from the first electrically conductive material (pattern of Au surface layer wiring conductors 17, see figure 1, column 3, line 10-20);

a barrier cap formed in contact with and between the via and the contact pad, the barrier cap being formed from a third electrically conductive material that is different from the first and second electrically conductive material (Au/Ag intermediate metal layer, see figure 1, column 3, line 10-20); but

fails to disclose a dielectric ring covering a peripheral portion of the contact pad and an adjacent portion of the dielectric material layer surface immediately surrounding the contact pad, such that any solder that is applied to the contact does not contact the peripheral portion of the contact pad or the ceramic material.

However, such coating of solder mask or resist is known in the art for avoiding short circuit between the pads and further, protecting the outer surface for environmental degradation.

Kumagai discloses such glass coating for covering the resistive element and pads, overcoat glass 6, figure 1a, column 8, line 60-65.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the structure of Kawakami with suitable coating on the pads, as taught by Kumagai, in order to protect the top surface and to avoid short circuit between the adjacent contact pads.

Regarding claims 3 and 16, the combination of Kawakami and Kumagai, further discloses the dielectric material is glass; see Kumagai, overcoat glass coating 6, column 8, line 60-65.

Regarding claim 4 and 17, though Kawakami does not disclose, the dielectric material partially embedded within the surface of the first ceramic layer, it will depend upon the design of the via hole and the contact pad and the specific requirement, such as to cover the contact pad periphery only or to cover the whole surface of the ceramic layer including any component on the surface.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the combination structure of Kawakami and Kumagai with dielectric material partially embedded in order to just cover the periphery of the contact pads only instead of the whole surface of the ceramic layer.

Regarding claims 5 and 18, Kawakami does not explicitly disclose the circuit structure is mounted on printed circuit board, it is common to have the structure

installed on the printed circuit board such as mother board for interconnection of the device with other component in the assembly such as for power or signal connections.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the combination structure of Kawakami and Kumagai installed on a printed circuit board in order to interconnection with other component of the assembly.

Regarding claim 6 and 19, though Kawakami does not disclose the contact pad embedded into the surface of the ceramic layer, such design is known in the art to just expose the pad for connection and not the conductor pattern to have better control of the short circuit without even additional mask or resist. Further this design of embedding the contact pad will provide a better planar surface for electrical connection. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the combination structure of Kawakami and Kumagai with contact pad embedded in the ceramic layer in order to have better planner surface for external connection.

Regarding claim 7 though the combination structure of Kawakami and Kumagai is disclosing three different materials for via hole, intermediate / barrier cap and contact pad, not discloses explicitly as claimed by the applicant, first electrically conductive material filling the through hole is palladium-silver, second electrical conductive material forming the contact pad is platinum-gold and the third electrically conductive material

forming the barrier cap layer is gold. However, the crux of providing an intermediate layer is to have a better contact of via hole material with the contact pad and any suitable combination can be used to have the better and reliable continuity and all the materials as claimed are known in the art.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the combination structure of Kawakami and Kumagai with combination of materials as claimed in order to have better and reliable electrical continuity.

Regarding claims 25 and 27, though the combination structure of Kawakami and Kumagai does not disclose the solder ball formed within the dielectric ring. Such solder ball connections are well known in the art for connecting the component circuit board or for connecting an assembly package to a circuit board.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the combination structure of Kawakami and Kumagai with the solder ball formed within the dielectric ring in order to connect the circuit assembly with other circuit board.

Allowable Subject Matter

6. Claims 8-12 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, for claim 10, and the drawing rejections, set forth in this Office action.

Response to Arguments

7. Applicant's arguments with respect to claims 1 and 15 have been considered but are moot in view of the new ground(s) of rejection. New secondary prior art of Kumagai discloses the resist covering the periphery of the contact pads.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Berger et al., discloses substrate with contact region flush with the ceramic layer, see figure 2.

Traskos et al., disclose intermediate ceramic substrate with contact region flush with the ceramic layer, see figure 7.

Fukasawa discloses solder ball on the pad, see figure 2A and 3B, the circuit board can be of either organic material or inorganic material, column 2, line 50-55.

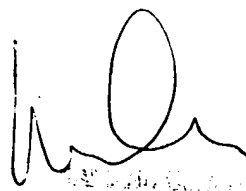
Branchevsky discloses solder ball on pad, see prior art figure 1 and 2.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ishwar (I. B.) Patel whose telephone number is (703) 305 2617. The examiner can normally be reached on M-F (8:30 - 5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L Talbott can be reached on (703) 305 9883. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305 3431 for regular communications and (703) 305 7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308 0956.

ibp
May 24, 2003


SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2827